REMARKS/ARGUMENTS

In view of the remarks herein, favorable reconsideration and allowance of this application are respectfully requested. Claims 1-5, 7-17, and 19-22 are pending. Claims 1 and 10 have been amended solely in an effort to advance prosecution

Support for the amendment to claim 1 may be found in claim 2 (e.g., the induction time τ), now-canceled claim 6, as well as throughout the specification, including page 13, lines 3-4.

Support for the amendment to claim 10 may be found in now-canceled claim 18.

Claims 2 and 11 were indicated as allowable if rewritten in independent form. Applicants respectfully believe that all claims as amended are allowable.

Claims 1, 3-10, and 12-22 were rejected as allegedly unpatentable as obvious over various references: Claims 1, 3-8, 10, and 12 were rejected over U.S. Patent No. 5,690,829 to Lauer (Lauer) in view of U.S. Patent No. 6,099,733 to Haney (Haney) and U.S. Patent No. 4,176,057 to Wheatley et al. (Wheatley). Claim 13 was rejected over Lauer in view of Haney and Wheatley in further view of U.S. Patent No. 5,415,781 to Randhahn et al. (Randhahn). Claims 9 and 18 were rejected over Lauer in view of Haney and Wheatley in further view of U.S. Patent No. 6,036,867 to Jogand et al. (Jogand). Claims 14-17 were rejected over Lauer in view of Haney and Wheatley in further view of U.S. Patent No. 6,838,001 to Zeiher et al. (Zeiher) and U.S. Patent No. 6,432,310 to Andou et al. (Andou). Claims 19-21 rejected over Lauer in view of Haney, Wheatley, and Jogan in further view of U.S. Patent No. 4,318,772 to Kragh (Kragh). Claim 22 was rejected over Lauer in view of Haney, Wheatley, and Jogan in further view of U.S. Patent No. 6,468,389 to Harris et al. (Harris).

Applicants understand that the Examiner has acknowledged the allowability of claims 2 and 11, which recite certain features, namely, the use of the induction time as an index for the

periodicity of flow reversal in pressure-driven membrane processes, e.g., in water desalination systems. The induction time is a technical feature associated with the composition of the water, namely, with the sparingly soluble salts and/or minerals present in the water and the membrane used (the induction time is the time required for a supersaturated water stream to precipitate one or more of the sparingly soluble salts and/or minerals therefrom). The description provides various techniques for determining the induction time (see, for example, Example 2 and also the procedures given in Example 4 on pages 41-45). By means of using the induction time as the index for periodicity, the reversal of the direction of the feed flow is set essentially before initiation of membrane fouling, i.e., before the transformation of solutes from the solubilized state into the solid state occurs.

It is not self-evident nor intuitively obvious that the accumulating time for commencement of precipitation of salts and minerals is reset once relieving the super-saturation conditions to which the membrane is exposed (by reversing the flow direction and hence exposing the membrane to under-saturated solution). In this regard, the Patent Office's attention is drawn to the comparison illustrated in Figures 5 (comparative) and 6 of the specification. The Patent Office will note the periodical, stable behavior of a calcium sulfate solution treated according to the claimed subject matter, namely, alternately exposing the membrane surface to a super-saturated and under-saturated solutions, as opposed to the rapidly declining flux displayed in Figure 5 (involving no such switching). Thus, a sharp decline is not observed in the flux produced by claimed subject matter (see also Figure 13 of the present specification).

There is nothing in the prior art suggesting that a reverse flow scheme in which the time between flow transitions is kept lower than the induction time may effectively prevent precipitation fouling of salts and minerals onto the membrane surface.

Lauer relates to a process for the production of water, starting from raw water comprising particles of dirt, as may be readily appreciated upon reviewing the following quotation from Lauer (see column 2, lines 18-28):

> Through a reversal in the direction of flow of the water past the membrane or membranes, both end areas of the module being used are utilized. When this is done, the particles of dirt that had come to rest, particularly in the area that was facing the direction of flow before the reversal of the flow direction, are rinsed out, while the opposite end area of the module, which until then had been less heavily loaded with particles of dirt, forms the front-most area in the direction of flow until the next reversal in the direction of flow.

It follows that the flow reversal according to Lauer serves the purpose of treating already deposited solid particles, and not the purpose of preventing precipitation fouling of salts and minerals onto the membrane surface. Even stronger evidence that the intention of Lauer is merely rinsing and cleaning out already deposited particles is the inclusion of backwash from the pure water side to the raw water side during the transition from forward flow to reverse flow, as seen in claim 1 of Lauer.

As to the periodicity of the reversal of flow direction, Lauer gives the following guidance:

> It is beneficial if the intervals of time that are provided for a reversal of the direction of flow and/or for a change of the water pressure at the membrane 4, and/or the extent of the water pressure change at the membrane 4, are chosen depending on the degree of contamination of the raw, or feed water. (column 7, lines 38-43).

In view of the fact that the fouling material according to Lauer consists of dirt particles which accumulate on the membrane, it follows that Lauer utilizes the flow reversal in order to reduce the load of such dirt particles on the membrane by rinsing them out. There is absolutely no rationale according to Lauer to carry out the reversal of the flow direction at a periodicity

based on the induction time associated with salts and mineral, in order to prevent the crystallization of said salts from the water onto the membrane, if the fouling material is in the form of solid particles of dirt already at the beginning of the process. In contrast, the claimed subject matter utilizes the flow reversal in order to prevent the formation of insoluble salt through crystallization processes. Thus, the time between flow transitions is kept lower than the induction time, thereby preventing precipitation fouling of salts and minerals onto the membrane surface. This is done by relieving the super-saturation conditions to which the membrane is exposed (by reversing the flow direction and hence exposing the membrane to under-saturated solution).

This deficiency of Lauer, namely, its lack of disclosure regarding the use of the induction time as the periodicity index is not cured by the secondary references cited against claim 1, namely, Haney and Wheatley.

Haney gives the following guidance regarding the setting of the periodic flow reversal (see column 37, lines 16-28):

> Once a pre-determined time, pressure drop, or other control cycle limit is met, service flow to the membrane separator(s) is reversed…Forward/reverse service flow cycle duration is set based upon the load presented to the filtration means 248 end.

In view of the fact that the indicator specifically proposed by Haney for setting the flow reversal is the pressure drop, which is observed after the deposition of solids already takes place, it is clear that the object of the flow reversal according to Haney is to release solid captured by the filtration means, as indeed acknowledged by the second sentence cited above, and not to prevent precipitation fouling of salts and minerals onto the membrane surface. Similarly, see the

text on column 30, lines 12-18 of Haney specifically states that the flow reversal is intended to clear particles and sludge.

In view of the above, it is clear that Haney deals strictly with already deposited material and not with the prevention of precipitation of material that is still in solution. Having taught the use of post-crystallization indicators as the periodicity index, Haney teaches away from using the induction time as the periodicity index.

Applicants respectfully note that it is not entirely clear whether the other secondary reference, namely, Wheatley, was combined together with the Lauer and Haney against claim 1. In any case, it is submitted that Wheatley is unrelated to the setting of flow reversal and adds nothing in this regard. Wheatley et al deal with the chemical treatment of the concentrate, namely, the addition of suitable chemical compounds into the concentrate reactor used for receiving the concentrate from the reverse osmosis unit in order to induce crystallization of sulfate. Wheatley et al deal also deal with the interruption of the operation of the reverse osmosis unit for the purpose of washing, following which the system is placed back on stream. However, this is unrelated to the pending claims.

In conclusion, the ternary combination consisting of Lauer in view of Haney and Wheatley does not render obvious a method of flow-reversal using the induction time as the flow-reversal periodicity index as set forth in claim 1.

With respect the independent system claim 10, it is noted that it is combined of old claim 10 and 18, reciting the following two limitations:

(i) a control unit adapted to set the periodicity of the flow reversal employing the induction time as the periodicity index; and
(ii) a crystallizer for receiving the concentrate withdrawn the said pressure vessel, for precipitating the sparingly soluble salts and/or minerals in said crystallizer.

Applicants note that old claim 18 has been rejected in view of a quaternary combination composed of Lauer in view of Haney, Wheatley and Jogand. The latter relates to a chemical treatment commonly applied in desalination processes (the addition of precipitation inhibitors, known as antiscalants). Thus, in view of the analysis set forth above, the system of claim 10 is not rendered obvious by said combination of references.

Because the independent claims are patentable, so too are their dependents.

The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Account No. 14-1140.

If any small matters remain outstanding (e.g., matters that can be resolved via an Examiner's Amendment), the Examiner is encouraged to telephone Applicants' representative. Prompt reconsideration and allowance of this application is requested.

Respectfully submitted,

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